

1 METHOD AND SYSTEM FOR HIGH-SPEED

2 TABLET COUNTING AND DISPENSING

3

4 This application is a continuation-in-part of U.S.
5 Serial No. 10/430,117, filed on May 6, 2003, which is a
6 continuation-in-part of 09/975,608, filed October 11, 2001,
7 each incorporated by reference herein in its entirety.

8

9 BACKGROUND OF THE INVENTION

10

11 1. Field of the Invention

12 This invention relates broadly to medicament tablet
13 counting and dispensing apparatus. More particularly, this
14 invention relates to tablet feeding and counting apparatus
15 which are adapted to dispense any selected number of
16 tablets, up to a maximum number, with minimal dispensing
17 delay.

18

19 2. State of the Art

20 In retail, hospital, and mail order medication
21 dispensing, a large number of different prescriptions of
22 single dose medications, such as tablets, must be filled.
23 (Hereinafter, reference to "tablets" should be understood

1 for purposes herein as being generic to tablets, capsules,
2 caplets and any other solid dose medication).

3

4 Larger quantity prescriptions are often filled with
5 the aid of a counting apparatus intended to more rapidly
6 count different quantities of different tablets
7 successively. For example, a prescription for ninety
8 tablets of 10 mg Claritin® may need to be filled after a
9 prescription for sixty tablets of 400 mg Motrin®.

10

11 With an automatic tablet counter, the pharmacist
12 obtains a bulk container of a prescription medication from
13 a shelf and then pours from the container a quantity of
14 tablets into a hopper of the counting apparatus. The
15 pharmacist then sets the counting apparatus to the number
16 of tablets to be counted, e.g., ninety. Assuming at least
17 the required number of tablets for the prescription has
18 been poured into the hopper, the pharmacist waits while the
19 counting apparatus counts the required number of tablets
20 and dispenses the tablets into a patient prescription
21 bottle. The excess tablets are discharged back into the
22 bulk container, which is then replaced on the shelf. It
23 has been found that the time taken to discharge the excess

1 tablets can be equal to or greater than the time required
2 to count the prescription.

3

4 Each prescription medication must be obtained from a
5 bulk storage container located in stock, which must be
6 opened prior to use and closed after use. In order to
7 minimize the time taken to dispense a prescription, counter
8 manufacturers have provided "cassette counters" for retail,
9 hospital, and mail order pharmacies. Each cassette is
10 designed for a specific size and shape capsule, tablet, or
11 caplet. The cassettes are pre-filled by the pharmacist
12 with bulk quantities of the appropriate prescription drugs,
13 and are used to store bulk quantities rather than using the
14 container supplied by the manufacturer. The prescription
15 medication is then dispensed directly from the cassette.
16 The use of cassettes eliminates the time needed to open the
17 manufacturer's original container, the time needed to
18 return excess tablets to the container, and the time needed
19 to close the container.

20

21 However, there are situations, particularly in bulk
22 mail order pharmacies and high volume hospital dispensing,
23 where greater dispensing speed is desired than is currently

1 provided by automatic dispensing systems, particularly for
2 the most frequently dispensed medications.

3

4 SUMMARY OF THE INVENTION

5

6 It is therefore an object of the invention to provide
7 a system for dispensing a selected quantity of tablets
8 extremely rapidly, irrespective of the type of tablet and
9 the quantity of tablets dispensed.

10

11 It is another object of the invention to provide a
12 system for dispensing tablets which functions with all
13 tablets regardless of size, shape, and weight.

14

15 It is an additional object of the invention to provide
16 a system for dispensing tablets which is not prone to
17 clogging.

18

19 It is a further object of the invention to provide a
20 system for dispensing tablets which is efficient.

21

22 In accord with these objects, which will be discussed
23 in detail below, a system and method for storing and

1 dispensing discrete objects, such as 'tablets' (stated
2 above to be generic for tablets, capsules, caplets and any
3 other solid dose medication), is provided and adapted to
4 dispense a number of tablets, up to a maximum number,
5 without a delay associated with counting the tablets.

6

7 The system and methodology include first counting and
8 storing a preset number of tablets in respective dedicated
9 chambers (storage locations), the combination of the
10 numbers of tablets within the chambers being useful for
11 dispensing commonly prescribed numbers of tablets.

12

13 According to one embodiment of the invention, n
14 chambers are provided, with 2^0 , 2^1 , 2^2 , ..., 2^{n-1} tablets
15 provided respectively in the individual chambers. Using
16 such a system, any number of tablets, up to the additive
17 combination of all the chambers (e.g., where $n=7$, the
18 additive combination is 127), can be dispensed from the
19 chambers by selectively emptying the chambers which
20 together add up to the selected number for dispensing.

21

22

1 Because the number of tablets in each of the chambers
2 is always the same, the system optionally can be hardwired
3 to select the tablets from the required chambers without
4 any combinatorial computation process; i.e., for any number
5 of tablets selected for dispensing, there always exists a
6 particular readily determinable combination of chambers
7 which can be emptied to comprise the selected number of
8 tablets exactly. Alternatively, the chambers can be
9 selected by a simple computational process; i.e., first
10 identifying the chamber having the largest number of
11 tablets less than the selected number for dispensing, then
12 identifying the chamber having the next largest number of
13 tablets, provided that the addition of such number of
14 tablets to the previously identified chamber does not
15 exceed the selected number for dispensing, then identifying
16 the chamber having the next largest number of tablets,
17 provided that the addition of such number of tablets to the
18 previously identified chambers does not exceed the selected
19 number for dispensing, etc., until the desired number of
20 tablets has been identified. As each chamber is
21 identified, or after all have been identified, the exit
22 gates are released, preferably in succession, to dispense
23 the tablets.

1 According to another embodiment of the invention,
2 there are n chambers, where n preferably equals at least
3 four, and the number of tablets in a particular chamber i
4 is preferably 2^{i+2} , where $i = 1 \dots n$. In accord with this
5 embodiment, a direct feed channel is provided in addition
6 to the chambers. The direct feed channel feeds
7 individually counted tablets into an exit chute in
8 combination with the tablets dispensed from the chambers.
9 The direct feed channel is primarily provided for counting
10 up to $2^{i+2}-1$ tablets, where i preferably equals one, e.g.,
11 seven tablets. As such, the direct feed channel in
12 combination with the chambers permits dispensing of any
13 number of tablets up to $\sum_{i=1}^n 2^{i+2} + 7$; e.g. where $n=4$, up to 127
14 tablets. However, it is certainly appreciated that the
15 chambers may store a non-exponentially incremented number
16 of tablets, and that the direct feed channel may be used to
17 supply up to another number of tablets.

18

19 After the selected chambers are emptied tablets are
20 fed from a feeder which stores bulk quantities of the
21 tablet, counted, and directed into the emptied chambers to
22 refill the chambers with the preset number of tables. The

1 direction of the tablets into the emptied chambers for
2 filling is preferably controlled by refill gates which open
3 to receive or direct the required number of tablets and
4 close once appropriately refilled. It is appreciated that
5 only those chambers which are emptied after dispensing need
6 to be refilled and, as such, only the number of tablets in
7 those storage locations need to be counted.

8
9 According to another aspect of the invention, each
10 chamber *i* may include subchambers which are each filled
11 with the appropriate number of tablets for the chamber.
12 Then, when activated, a subchamber of the chamber is
13 emptied. The remaining filled subchambers are then ready
14 for subsequent dispensing while the emptied subchamber is
15 being refilled. As such, the user is not required to wait
16 before attempting to dispense another prescription for the
17 tablets. Moreover, during a single dispensing operation
18 more than one subchamber of a chamber may be emptied,
19 particularly when large numbers of tablets are to be
20 dispensed.

21

22 In addition, an overflow chamber may be provided for
23 extra tablets which are inadvertently fed into the refill

1 system after the required count to fill one or more of the
2 chambers has been met. A count is kept of the tablets in
3 the overflow chamber, and the overflow chamber is emptied
4 during the subsequent dispensing or when the number therein
5 is suitable in combination with one or more other chambers
6 to meet an input number of tablets for dispensing.

7

8 The system may include a plurality of cells, each
9 including a plurality of chambers for a different solid
10 dose medication. The solid dose medication may then be
11 selected along with the number of tablets required to be
12 dispensed.

13

14 Additional objects and advantages of the invention
15 will become apparent to those skilled in the art upon
16 reference to the detailed description taken in conjunction
17 with the provided figures.

18

BRIEF DESCRIPTION OF THE DRAWINGS

1

2

3 Fig. 1 is a schematic view of a medicament tablet
4 counting and dispensing system according to the invention
5 including a cell provided with chambers having tablets;

6

7 Figs. 2, 3 and 4 are schematic views of the tablet
8 counting and dispensing system of Fig. 1, showing a
9 sequence for release and closure of exit gates;

10

11 Figs. 5, 6 and 7 are schematic views of the tablet
12 counting and dispensing system of Fig. 1, showing a
13 sequence for opening and closure of refill gates;

14

15 Fig. 8 is a schematic section of a side elevation view
16 of a first embodiment of a multi-cell tablet counting and
17 dispensing system;

18

19 Fig. 9 is a schematic section view through line 9-9 in
20 Fig. 8;

21

22 Fig. 10 is a schematic view of a second embodiment of
23 a multi-cell tablet counting and dispensing system;

1

2 Fig. 11 is a perspective view of another embodiment of
3 an tablet counting and dispensing system according to the
4 invention; and

5

6 Fig. 12 is a schematic view of the system of Fig. 11.

7

8 Fig. 13 is a flow chart illustrating control
9 operations in loading tablets into a subchamber of the
10 tablet counting and dispensing system of Figs. 11 and 12.

11

12 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

13

14 Turning now to Fig. 1, a tablet dispensing system 10
15 is shown which includes a hopper 12 which stores a bulk
16 quantity of tablets, a feeder 14 which feeds tablets from
17 the hopper 12 to a cell 16, which is described in more
18 detail below, a counter 18 which counts the tablets fed by
19 the feeder to the cell 16, and a controller 34 which
20 operates the cell 16 and permits a user to enter or select
21 the number of tablets to be dispensed.

22

1 The hopper 12, feeder 14 and counter 18 may be of any
2 type known in the art suitable for counting small discrete
3 objects, such as tablets. For example, the hopper 12 and
4 feeder 14 may be a vibratory bowl feeder, a mechanical
5 feeder, or a cassette system such as described in co-
6 pending U.S. Ser. No. 09/871,531, filed May 31, 2001, which
7 is hereby incorporated by reference herein in its entirety,
8 each of which may have an integrated unit which functions
9 as both a hopper and a feeder. The counter 18 is
10 preferably an optical system which uses an optical sensor
11 array, such as that disclosed in co-owned U.S. Patent No.
12 5,768,327, which is hereby incorporated by reference herein
13 in its entirety. The optical sensor array of U.S. Patent
14 No. 5,768,327 includes an orthogonal arrangement of two
15 discrete optical sensors which together sense objects in
16 three dimensions. This sensor arrangement is adapted to
17 sense multiple objects simultaneously falling past the
18 sensors.

19
20 The cell 16 includes a plurality of vertically-stacked
21 inclined chambers (storage locations) 20 positioned below
22 the counter 18. Seven chambers sequentially numbered one
23 through seven are shown in the embodiment of Fig. 1. The

1 chambers 20 each have a fill gate 22 and an exit gate 24.
2 When the fill gate 22 of any chamber is open, that chamber
3 is in communication with a feed chute 26 and thereby
4 adapted to receive tablets 28 fed from the feeder 14 and
5 counted by the counter 18. With the respective exit gates
6 24 closed, each chamber 20 stores a predetermined, and
7 preferably different, number of tablets. As discussed in
8 more detail below, when the exit gate 24 of any chamber is
9 in an open position, the tablets stored within the chamber
10 20 are released into an exit chute 30, and from the exit
11 chute 30 the tablets are dispensed into a container 32.
12 The fill gates and exit gates are preferably
13 electromechanically controlled, e.g., with solenoids
14 powered by the controller 34, to effect movement of the
15 gates between open and closed positions.

16

17 The combination of the numbers of tablets within the
18 plurality of chambers 20 is capable of comprising any
19 number of tablets which is desired for dispensing.
20 According to a preferred system, n chambers are provided,
21 with 2^0 , 2^1 , 2^2 , ..., 2^{n-1} tablets provided respectively in
22 the individual chambers 20. Using such a system, any
23 number of tablets, up to the additive combination of all

1 the chambers (e.g., where $n=8$, the additive combination is
2 255), can be dispensed by selectively emptying the chambers
3 which together add up to the selected number for
4 dispensing.

5

6 As shown in Fig. 1, in an embodiment of the invention,
7 seven chambers 20 are provided; i.e., $n=7$. The chambers
8 are provided with tablets as follows: chamber one includes
9 one tablet (2^0); chamber two includes two tablets (2^1);
10 chamber three includes four tablets (2^2); chamber four
11 includes eight tablets (2^3); chamber five includes sixteen
12 tablets (2^4); chamber six includes thirty-two tablets (2^5);
13 and chamber seven includes sixty-four tablets (2^6).

14

15 Referring to Fig. 2, if it is desired to dispense,
16 e.g., twenty-six tablets, twenty-six tablets are selected
17 at the controller 34 which causes the exit gates 24 of
18 chambers two, four and five to be opened. The gates may be
19 opened simultaneously. However, in the embodiment of the
20 invention as shown, where the gates swing open, the gates
21 are preferably opened in succession and at time intervals,
22 e.g., 0.25 seconds between each opening, starting with the
23 gate of the lowermost chamber. The time interval prevents

1 jamming by the tablets. As the exit gates are opened, the
2 tablets in the respective chambers (two, eight, and sixteen
3 tablets, respectively) are released into the exit chute 30.
4 The sixteen tablets from chamber five fall directly into
5 the container, while the tablets from chambers four and two
6 are retained the open exit gates of chambers five and four
7 respectively. Referring to Fig. 3, the exit gates 24 are
8 then closed from the bottom up, preferably again in
9 succession and at a short time interval, to release the
10 retained tablets into the chute 30 for dispensing. That
11 is, when the exit gate 24 of chamber five is closed, the
12 tablets from chamber four which were resting on that gate
13 are released to fall through the exit chute 30 and into the
14 container. Likewise, when the exit gate 24 of chamber four
15 is closed, the two tablets retainer from chamber two fall
16 into the container 32. Referring to Fig. 4, the exit gate
17 24 of chamber two, previously holding the two tablets is
18 then closed.

19

20 As is discussed hereinafter, because the number of
21 tablets in each of the particular chambers 20 is kept
22 constant (due to refilling), the system optionally can be
23 hardwired at the controller 34 to open the exit gates from

1 the required chambers without any combinatorial computation
2 process; i.e., for any number of tablets selected for
3 dispensing, there always exists a particular readily
4 determinable combination of chambers which can be emptied
5 to comprise the selected number of tablets exactly, up to
6 the maximum number of tablets stored in the cell 16.

7
8 Alternatively, the chambers can be selected by a
9 simple computational process performed by the controller
10 34, for example, by first identifying the chamber having
11 the largest number of tablets less than the selected number
12 for dispensing, then identifying the chamber having the
13 next largest number of tablets, provided that the addition
14 of such number of tablets to the previously identified
15 chamber does not exceed the selected number for dispensing,
16 then identifying the chamber having the next largest number
17 of tablets, provided that the addition of such number of
18 tablets to the previously identified chambers does not
19 exceed the selected number for dispensing, etc., until the
20 desired number of tablets has been identified. As each
21 chamber is identified, or after all have been identified,
22 the exit gates are opened and closed, preferably in
23 succession as described above, to dispense the tablets.

1

2 The tablet dispensing system requires no tablet
3 counting time because the chambers of the cell are
4 preloaded. The only time required is for the gates to open
5 to release and empty the tablets from the identified
6 chambers. While time is required to refill the emptied
7 chambers, the refill occurs after dispensing and presumably
8 while the system operator is completing the prescription
9 requirement (e.g., labeling, data entry, packaging, etc.)
10 or identifying and/or preparing the subsequent prescription
11 information; i.e., refill occurs during system operator
12 downtime.

13

14 After the identified chambers have been emptied, such
15 chambers need to be refilled for subsequent dispensing
16 operations. Referring now to Fig. 5, the fill gates 22 of
17 the emptied chambers (chambers two, four, and five in the
18 example) are opened, and the tablets 28 are fed by the
19 feeder 14 from the hopper 12 to the counter 18 (which is
20 preferably an optical counter such as disclosed in co-owned
21 U.S. Patent #5,768,327). Once the counter counts the
22 required number of tablets for the uppermost emptied
23 chamber (chamber two), and after a short predetermined

1 delay to permit the tablets to fall through the fill chute
2 26 to the respective chamber, the fill gate of that chamber
3 is closed, as shown in Fig. 6. Still referring to Fig. 6,
4 then the tablets required for the next chamber (i.e.,
5 chamber four) are counted, enter the fill chute and fall
6 through the open fill gate to the chamber. Referring to
7 Fig. 7, once chamber four is refilled, its respective fill
8 gate 22 is closed, and chamber five is refilled in a like
9 manner. It is appreciated that only those chambers which
10 are emptied after dispensing need to be refilled and, as
11 such, only the number of tablets in those chambers need to
12 be counted. It is also appreciated that the dispensing
13 system is initialized by counting and directing the
14 required number of tablets to each of the respective
15 chambers.

16

17 Referring to Figs. 8 and 9, a tablet dispensing system
18 110 may include a plurality of radially arranged cells 116
19 each including a plurality of chambers 120 for a different
20 solid dose medication. Each of the cells 116 is preferably
21 provided with its own hopper 112, feeder 114 and counter
22 118. The solid dose medication may be selected from a
23 controller (not shown) along with the number of tablets

1 required to be dispensed. A common exit chute 130 can be
2 used for dispensing into a bottle or container.

3

4 Turning now to Fig. 10, another embodiment of a multi-
5 cell tablet dispensing system 210 is shown. Each cell 216
6 includes its own hopper 212 and preferably a feeder 214. A
7 common counter 218 may be movable between the hoppers 212,
8 feeders 214, and the cells 216. Alternatively, the feeder
9 214 may be integrated with the counter 218 and also movable
10 relative to the hoppers 212 and cells 216. From the above
11 multi-cell system embodiments, is understood that various
12 other configurations of a multi-cell system may be
13 implemented.

14

15 While the preferred system includes cells with n
16 chambers provided with $2^0, 2^1, 2^2, \dots, 2^{n-1}$ tablets in the
17 respective chambers, it will be appreciated that chambers
18 having another arrangement of tablet quantities may be
19 used, provided that such arrangement permits the desired
20 number of tablets to be dispensed. It is appreciated that
21 not every number of tablet need be able to be dispensed,
22 just those quantities which are generally prescribed.

1 Prescribed quantities are generally in multiples of 7 or
2 10.

3

4 Turning now to Figs. 11 and 12, another embodiment of
5 a dispensing system 310 for tablets is shown. The system
6 310 generally includes many of the features described
7 above, including a hopper 12, a feeder 14, and a counter
8 18. The system 310 also includes a cell 316 preferably
9 having n primary chambers 320 for storing tablets, where n
10 is preferably greater than or equal to four. The number of
11 tablets in a particular chamber i is preferably 2^{i+2} , where
12 $i = 1 \dots n$. Thus, for exactly four chambers 320, according
13 to a presently preferred embodiment, a first chamber 320a
14 preferably includes eight tablets, a second chamber 320b
15 preferably includes sixteen tablets, a third chamber 320c
16 preferably includes 32 tablets, and a fourth chamber 320d
17 preferably includes 64 tablets. The cell 316 preferably
18 also includes a fifth chamber 320e, the purpose of which is
19 described further below. With four primary chambers, the
20 chambers are adapted to dispense a large range of numbers
21 of tablets, between 8 and 120 tablets, and even up to 240
22 using multiple chambers and double dispensing, as discussed
23 below.

1

2 A direct feed channel 340 is provided in addition to
3 the cell 316. The direct feed channel 340 provides
4 automatic feed-through of individually counted tablets in a
5 manner which bypasses the chambers 320 of the cell 316.

6 The direct feed channel 340 is primarily provided for
7 counting up to the number of tablets stored in the cell
8 chamber having the fewest number of tablets. For example,
9 if the first chamber 320a stores eight tablets, the direct
10 feed channel 340 is provided for automatically feeding up
11 to seven tablets into the chute 330. As such, for $n=4$, the
12 chambers 320 in combination with the direct feed channel

13 340 permit dispensing of any number of tablets up to $\sum_{i=1}^n 2^{i+2} + 7$

14 (i.e., 127 tablets), without requiring three additional
15 chambers for 1 (2^0), 2 (2^1) and 4 (2^2) tablets, as in the
16 prior embodiments. Moreover, there is no need to direct
17 feed more tablets than already pre-counted and stored in a
18 chamber.

19

20 According to a preferred aspect of the invention, each
21 chamber 320 preferably includes a plurality of subchambers,
22 such as 342, 344, 346. Each of the subchambers 342, 344,

1 346 can be provided with the respective number of tablets
2 for that chamber 320. That is, if a chamber 320 is
3 designated to dispense eight tablets at a time, then each
4 of the subchambers 342, 344, 346 is preferably provided
5 with eight tablets, though it is appreciated that at any
6 given time one or two of the subchambers may be emptied of
7 tablets and awaiting refill. In a preferred embodiment,
8 the chambers 320 are generally circular, with the
9 subchambers 342, 344, 346 defined by sectors formed by
10 radially extending walls 348 located 120° apart about a
11 central hub 350. The chambers 320 are preferably mounted
12 for individual mechanical rotational movement by a
13 motorized actuation mechanism 352. The circumference of
14 each circular chamber 320 includes a rim 353 which
15 preferably extends within a stationary guide 355 at the
16 bottom of the gateway 360, described below, to facilitate
17 rotational alignment of the chambers 320. The chambers 320
18 also include an outer wall 354 provided with openings 356
19 into each of the subchambers. An enclosure 358, shown in
20 broken lines, is provided partially about the cell 316 to
21 retain tablets in the subchambers 342, 344, 346 and limit
22 release of the tablets within the subchambers. The
23 enclosure 358 has upper and lower apertures (not shown)

1 which permit tablets to be received into the chamber and
2 dispensed therefrom. When a subchamber is oriented in a
3 first direction, e.g., vertically upwards, the subchamber
4 is positioned to receive tablets fed through its opening
5 via the gateway 360. When a subchamber is oriented
6 vertically downwards, the subchamber is oriented to empty
7 its tablet contents via its opening 356 into the chute 330.
8 When a subchamber is oriented such that its opening is not
9 adjacent the gateway 360 or chute 330, the subchamber and
10 enclosure 358 merely store tablet contents.

11

12 Upon receiving an input for dispensing a certain
13 number of tablets, the necessary chambers to comprise the
14 largest number of tablets smaller than the input number are
15 actuated, e.g., by rotation, to empty their contents.
16 Alternatively, all chambers are rotated and only the
17 necessary chambers (or subchambers) are emptied, e.g., by
18 providing actuatable gates at the openings to the
19 subchambers. If necessary, tablets are automatically fed
20 into the direct feed channel 340 to complete the required
21 number of tablets. For example, if an input is received to
22 dispense ninety tablets, the fourth, second and first
23 chambers are rotated to empty eighty-eight ($64+16+8$)

1 tablets, and the direct feed provides an additional two
2 tablets, for a total of ninety tablets.

3

4 According to another aspect of the invention, it may
5 be desirable to be able to dispense a relatively large
6 number of tablets by emptying more than one subchamber of a
7 chamber. For example, if the number of tablets input for
8 dispensing is one hundred-eighty, and the cell includes
9 four primary chambers, each with three subchambers, of
10 which two such subchambers of each chamber are preferably
11 filled at any one time, the cell may be actuated to release
12 two subchambers, each with sixty-four tablets from the
13 fourth chamber 320d, one subchamber with thirty-two tablets
14 from the third chamber 320c, and one subchamber of sixteen
15 tablets from the second chamber 320b. Four tablets
16 automatically fed from the feeder 14 to the direct feed
17 channel 340 complete the request.

18

19 After a dispensing operation, tablets are fed from the
20 feeder through the gateway 360 to the appropriate chambers
21 for subchamber refilling. The gateway 360 is a series of
22 channels including the above described direct feed channel
23 340 and chamber channels 364, 366, 368, 370 which direct

1 tablets from a funnel 372 below the feeder 14 and into the
2 chambers 320a-e. Appropriate channels 340, 364, 366, 368,
3 370 are selected by operation of a plurality of actuatable
4 gates 374. The gates 374 are movable between opened and
5 closed positions to, at any given time, define a single
6 path for a tablet from the funnel 372 to one of the
7 channels 340, 364, 366, 368, 370. This permits subchambers
8 to be refilled with the designated number of tablets after
9 a dispensing operation, as well as the output of individual
10 tablets through the direct feed channel 340.

11

12 After a subchamber is filled with the appropriate
13 number of tablets, it is possible that an additional tablet
14 will have already been fed by the feeder 14 to the counter
15 18, but not yet counted. As such, after filling a chamber,
16 the gates 374 move to a default position whereby such an
17 extra tablet is provided to the fifth chamber 320e. The
18 fifth chamber 320e operates as a temporary repository for
19 such tablets. Generally, no more than one extra tablet
20 would be counted per chamber. As such, with four chambers,
21 up to four tablets may be provided to the fifth chamber
22 upon each refill of the chambers. A count is kept of the
23 tablets in the fifth chamber 320e, and the tablets in the

1 fifth chamber are preferably dispensed along with the
2 tablets in other appropriate chambers (i) when the number
3 in the fifth chamber 320e is suitable in combination with
4 one or more other chambers 320a, 320b, 320c, 320d to meet
5 an input number of tablets for dispensing, or (ii) during
6 every dispensing in combination with one or more other
7 chambers and an appropriate number of tablets provided
8 through the direct feed channel 340. Emptying the fifth
9 chamber 320e whenever tablets are stored therein,
10 regardless of how many tablets are in the fifth chamber,
11 prevents inadvertent storage of a relatively large number
12 of tablets which may be difficult to dispense in
13 combination with the other chambers 320a-d.

14
15 In the above embodiment, it is recognized that the
16 first chamber may be set to have more than eight tablets
17 and that direct feed may be used for more than seven
18 tablets. Moreover, while the chambers have been described
19 as having exponentially incremented numbers of tablets, it
20 is appreciated that it may be desirable to fill the
21 chambers with numbers of tablets which are multiples of
22 seven and/or ten, in view of the fact that most
23 prescriptions comprise a number of tablets in a multiple of

1 seven or ten. Moreover, the number of tablets designated
2 for a particular chamber can be altered via software or
3 hardware.

4

5 Fig. 13 is a flow chart that illustrates the
6 operations performed by a controller to load tablets into a
7 given subchamber *i* within the chambers 320a-e. It will be
8 appreciated that this process is readily extended to load
9 tablets into each subchamber within the chambers 320a-e,
10 and can be used to initially load tablets into the
11 subchambers as well as reload tablets into a subchamber
12 after it has been emptied as described below. The
13 operations begin in block B301 wherein the controller
14 determines whether the subchamber *i* is empty and thus
15 requires reloading of tablets. If not, the operation
16 returns to wait until this condition is satisfied. If so,
17 the operations continue to blocks B303 and B305. In block
18 B303, the controller controls actuation of the gates of the
19 feed channel (via electrical signals supplied thereto) to
20 define a feed path from the counter to the circular chamber
21 that includes subchamber *i*. It also controls rotation of
22 this circular chamber (via electrical signals supplied to
23 actuation mechanism 352) such that subchamber *i* is oriented

1 vertically and tablets supplied thereto will pass through
2 the opening in the outside wall of the circular chamber
3 into the subchamber *i*. In block B305, the controller
4 starts the feed of tablets into the counter and into the
5 feed channel to initiate the fill operation for the
6 subchamber *i*. The operations then continue to block B307.

7

8 In block B307, the controller monitors the count value
9 output by the counter to determine whether this count value
10 is less than the desired count value (which is the number
11 of tablets to be loaded into the subchamber *i*). When this
12 operation fails (the count value output by the counter is
13 equal to the desired count value), the operations continue
14 to blocks B309 and B311.

15

16 In block B309, the controller terminates the feed of
17 tablets into the counter and into the feed channel to
18 terminate the fill operation for the subchamber *i*.

19

20 In block B311, the controller controls actuation of
21 the gates of the feed channel (via electrical signals
22 supplied thereto) to define a feed path from the counter to
23 the fifth chamber 320e (e.g., overflow chamber), thereby

1 removing the supply path to the subchamber *i*. This
2 terminates the fill operation for subchamber *i* after
3 loading the desired number of tablets into the subchamber
4 *i*. Any extra tablets that may be fed into the counter are
5 stored in the fifth chamber 320e (e.g., overflow chamber).

6

7 It will be appreciated that the circular chambers
8 320a-e as described above provide logical groups of tablet
9 storage containers (e.g., the group of three subchambers
10 that make up a given circular chamber), wherein each group
11 is associated with a given number of tablets. This feature
12 enables high speed dispensing operations by selectively
13 emptying one or more of the tablet storage containers that
14 has been filled with the associated number of tablets.

15

16 In the exemplary embodiments described above, only one
17 of the storage containers of a particular group is filled at
18 a time, and one or more of the storage containers of the
19 particular group is emptied at a time. These features
20 provide for simple and efficient operation. Moreover, it is
21 preferred that one of the storage containers of a particular
22 group be capable of being filled simultaneously while
23 another storage container of the particular group is
24 emptied. This feature provides for decreased delays in
25 filling the storage containers that would otherwise result

1 in the event that such operations are performed
2 sequentially.

3

4 It will be appreciated that the multi-chamber cell 316
5 as described above may be readily adapted for use in a
6 multi-cell tablet dispensing system (Fig. 10). In this
7 configuration, the cell is realized by a multi-chamber cell
8 316 and supporting elements as described above with respect
9 to Figs. 11 through 13. From the above multi-cell system
10 embodiments, is understood that various other
11 configurations of a multi-cell system may be implemented.

12

13 There have been described and illustrated herein
14 several embodiments of a tablet dispensing system and a
15 method of dispensing tablets. While particular embodiments
16 of the invention have been described, it is not intended
17 that the invention be limited thereto, as it is intended
18 that the invention be as broad in scope as the art will
19 allow and that the specification be read likewise. Thus,
20 while the gates may be operated with a solenoid, it is
21 appreciated that other means for moving the gates may be
22 used. Also, while swinging gates have been disclosed, it
23 will be appreciated that other types of gates can be

1 utilized. In fact, if vertical space is provided between
2 chambers, vertically moving gates may be utilized, and, in
3 some embodiments, when vertically moving gates are
4 utilized, all gates may be opened simultaneously, and all
5 tablets may be dispensed immediately. In addition, while a
6 particular number of chambers have been shown in each cell,
7 it will be understood that other numbers of chambers may be
8 used. Moreover, in one embodiment, while the number of
9 tablets in each of the chambers is shown to increase with
10 the successively lower located chambers, it is understood
11 that the number of tablets designated for the chambers can
12 be otherwise organized, e.g., a decreasing number of
13 tablets as the chambers are located lower, or with another
14 order to the number of tablets in relation to the location
15 of the chambers. In addition, while a controller is shown,
16 it is appreciated that the controller may comprise two or
17 more discrete systems; e.g., a system which permits user
18 input, a system which controls gate operation, a system
19 which controls the feeder, and a system which communicates
20 with the object counter to turn off the feeder once the
21 required number of tablets have been counted. Also, while
22 the system is described with respect to dispensing tablets,
23 it will be appreciated that the system and method apply to

1 the dispensing of other relatively small discrete objects.
2 Furthermore, aspects of one embodiment may be combined with
3 aspects of another embodiment. It will therefore be
4 appreciated by those skilled in the art that yet other
5 modifications could be made to the provided invention
6 without deviating from its spirit and scope as claimed.

7